

Forensic Science Center

Delivers a full range of forensic science capabilities to detect terrorism and illegal activities

The Forensic Science Center houses a variety of state-of-the-art analytical tools ranging from gas chromatograph/mass spectrometers to ultratrace chemical and DNA techniques. The Center's multidisciplinary staff provides expertise in organic and inorganic analytical chemistry, nuclear science, biochemistry, and genetics useful for supporting law enforcement and for verifying compliance with international treaties and agreements.

Since 1991, the Laboratory's Forensic Science Center has focused a comprehensive range of analytical expertise on issues related to nonproliferation, counter terrorism, and domestic law enforcement. LLNL's singular combination of human and technological resources has made the Center among the best of its kind in the world.

The Center houses a variety of state-of-the-art analytical tools ranging from gas-chromatograph/mass spectrometers to ultratrace chemical

and biological detection techniques. In the hands of an experienced staff of specialists, these and other technologies deliver a full range of forensic science capabilities to solve modern problems.

APPLICATIONS

- Law enforcement
- Counter terrorism
- Nonproliferation

Nuclear proliferation

As the threat of clandestine nuclear proliferation grows, the task of acquiring definitive information about a suspect nation's present and future nuclear capabilities becomes more demanding and complex. Such information includes activities related to the processing, procurement, diversion, or dispersion of special nuclear material.

To strengthen the Center's analytical capabilities, it has teamed with Laboratory experts in nuclear, radiochemical, isotopic, and inorganic

chemistry. This partnership expands the Center's technology base to include many varieties of sensitive equipment for detecting and discriminating all forms of nuclear radiation.

Identifying chemical samples

Unknown samples arrive at the Center in many different forms and states of stabilization. Some are water, vegetation, or soil samples; others are "wipes" of substances that may be related to clandestine weapons- production activities. The following new technologies are helping us precisely analyze and interpret such samples accurately:

- A portable chemistry analyzer known as an ion cyclotron resonance mass spectrometer (ICR-MS) can be configured to detect specific chemicals at very low levels of concentration. The low power requirements of the instrument and its simple electronic circuitry, together with the compactness of the spectrometer, the vacuum system, and the computer, permit a very small package no larger than a coffee can. We are also developing a version that can be left unattended in the field to perform diagnostic chemical analyses.
- A miniature gas chromatograph/mass spectrometer (GC/MS) completely self-contained in a 28-kg (~61-lb), suitcase-sized package can detect ultratrace (microgram or less) quantities of narcotics and compounds related to chemical-warfare agents, including their precursors and decomposition products. This instrumentation is ideally suited to support most nonproliferation and law enforcement efforts and investigations related to chemical pollutants released into the environment. The miniature GC/MS is now carried inside a suitcase, and we are working to reduce its size further so that it can fit into a briefcase.

- A new ion storage-time-of-flight (IS/TOF) mass spectrometer that we are currently building and testing allows extremely low levels (a few parts per trillion) of chemicals in air to be collected and detected very rapidly. This new instrument is unique in that it can acquire data on the order of thousands of spectra per second, making it suitable for high-speed aircraft sampling of air samples. Potential applications include identifying hazardous and chemical spills, monitoring industrial stacks and materials for volatile compounds, detecting concealed contraband, and surveying the environment. This instrument is particularly useful for sampling a released plume of smoke or airborne chemical that is only available for an instant of time.
- High-performance liquid chromatography and capillary electrophoresis/MS is being developed to identify minute quantities of compounds in complex samples. We are probing the lower limits of detection for many types of compounds isolated during an investigation.

Summary

Using the comprehensive array of sophisticated technologies from across the entire Laboratory, our Forensic Science Center is able

to quickly characterize evidentiary materials of importance both to national security and to forensic aspects of domestic law enforcement. The Center's analytical capabilities feature state-of-the-art sensitivities for detecting virtually any target compound contained in any sample. Our approach maximizes the information returned from limited samples collected by a variety of verification, inspection, monitoring, and law-enforcement agencies. As the pertinent technologies develop, we will continue to enhance these analytical tools and offer analysis support where needed.

Availability: Many of our technologies are available now to apply to modern problems. We welcome discussions with potential partners from industry and law enforcement groups.

Contact

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